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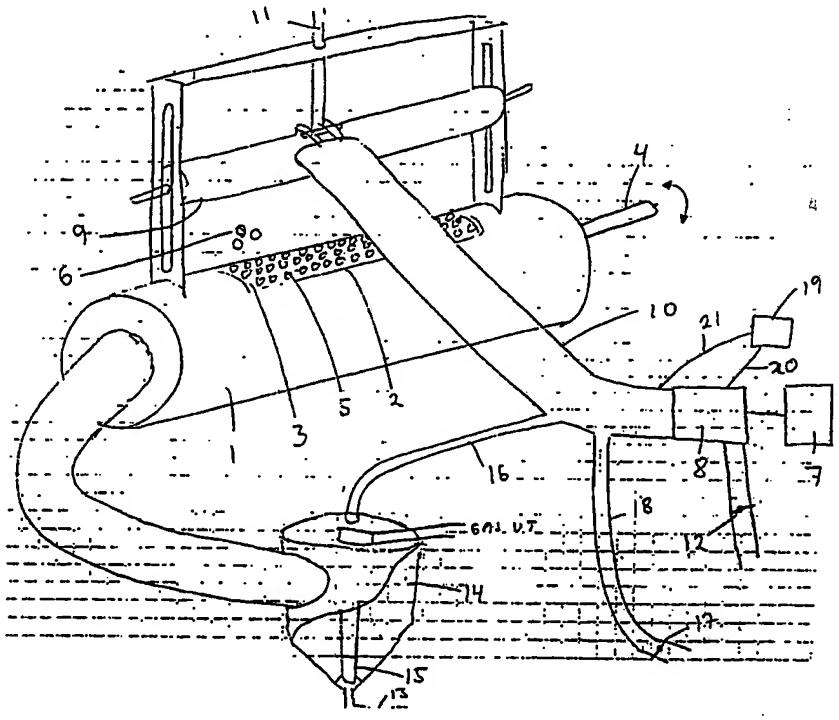


(57) Abstract

The invention relates to a gas generation portion for generating gas from solid fuels. In order to provide the best possible gasification process with regard to the nature of the fuel used at the time, the generation portion is adjustable and controllable within a wide range by the area of the gas take (1) as well as the distance between the primary air nozzle (9) and the gas take (1) being adjustable. To reduce fuel consumption, waste heat and exhaust gases are recovered and utilized in the gasification process.

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# A DEVICE FOR GENERATING GAS IN A GAS GENERATOR

It is well known that gas generators have a tarnished reputation with regard to the pollution they create and also with regard to the troublesome attention that is required. Furthermore such generators are unable to produce satisfactory gasification under load and the highest possible engine output power is therefore not achieved.

The poor total efficiency of an internal combustion engine is due to the considerable loss of heat through the exhaust gases and through the engine cooling water.

It has been found, however, that this energy can be recovered by passing the primary air of combustion first through a first heat exchanger for heat exchange with the engine cooling water and then through a second heat exchanger for heat exchange with the exhaust gases, therewith to improve the operating efficiency of a gas generator and of the engine, with subsequent improvement in range.

The actual generating part of the generator is constructed so that it can be adjusted to the best gasification process at that time with regard to the varying nature of the solid fuel.

The actual fuel container may include the generating part of the generator or the generating part may be placed in a smaller container which holds only a small amount of fuel, and to which fuel is supplied from a fuel magazine. A pipe connects the fuel container to the fuel magazine.

The present invention is intended for application with two-stroke and four-stroke engines comprising reciprocating pistons, although it can also be applied in rotary piston engines such as the Wankel engine.

However, it is probable that the invention can be also applied effectively in gas turbines and jet engines and also in gas generators that are intended for heating purposes. It will therefore be understood that the invention has a wide area of use.

An exemplifying embodiment of the invention will now be described in more detail with reference to the accompanying drawing, the single Figure which is a schematic illustration of the inventive gas generating arrangement.

The illustrated arrangement includes a fixed cylinder 1 which has an apertured part 2 and which is closed at one end and open at the other. A moveable cylinder 3 is mounted in the cylinder 1 and carries at one end a shaft 4 by means of which the cylinder 3 can be moved to a selected position by rotating the shaft 4, either manually or mechanically. Mounted in the fixed cylinder 1 is a grating 5 which can be brought to a given position in the aperture 2 and therewith exposed to solid fuel 6 that lies above the grating. The grating 5 and the aperture 2 coincide mutually both with regard to surface area and shape. The hole pattern of the grating, by which is meant the hole diameter and the centre-to-centre distance between the holes, is critical constructionally in obtaining qualitative and quantitative gas generation. The cylinder 3 may include several mutually different grating surfaces, so as to enable the best solid fuel gasification process to be obtained at that particular time, by appropriate rotation of the cylinder 3 with the aid of the shaft 4.

The primary air of combustion is taken primarily from the surrounding ambient air, secondarily from a cooling water heat exchanger 7, which is heated by an internal combustion engine and which is in constant use for the primary air required by the gas generator,

wherein the temperature of said heat exchanger being regulated by the cooling water thermostat of the engine, and thirdly from a heat exchanger 8 in which an exchange of heat takes place between the air of combustion and the exhaust gases. A primary air nozzle 9 is mounted between two holders which are provided with elongated slots, which may be straight or curved in shape. The illustrated primary air nozzle comprises a tubular member which is closed at both ends and which has an elongated slot ( not shown) which functions to spread a maximum amount of air over the surface of the grating 5. The tubular air nozzle 9 is guided for movement in the slots in the holders by means of a respective guide pin mounted on each end of the nozzle. Primary air is delivered to the nozzle 9 through an air duct 10 and the height of the nozzle 9 above the grating 5 and the aperture 2 can be adjusted through the medium of a schematically illustrated lifting and raising device 11. The temperature of the exhaust gas/primary air heat exchanger 8 is regulated by means of a throttle means 12. The thus heated primary air of combustion provides a significant heat boost which in turn results in an elevated reduction temperature. In order to prevent this elevated temperature from initiating destruction of the material exposed to reduction and oxidation, a certain amount of engine exhaust gases 13 are returned, these gases containing carbon dioxide which when coming into contact with glowing carbon undergoes an endothermic reduction to carbon monoxide. The exhaust gases are captured by a "catcher" which is inserted into the exhaust pipe. The catcher functions to capture exhaust gases, which enter under overpressure and are passed along a pipe to an ejector nozzle 15 mounted on the bottom of a cyclone purifier 14. The ejector is adapted so as to obtain a given overpressure and subpressure, such as to enable the stream of exhaust gas to return the carbon particles that settle continously on the bottom of the cyclone purifier. The returned

exhaust gases and carbon particles are passed to the combustion process through a pipe 16 leading to the primary air duct 10 and from there to the primary air nozzle. This returned exhaust gas lowers the reduction temperature. This temperature is again raised by activating the throttle 12, which results in raising the temperature of the exhaust gas/primary air heat exchanger and also in raising the reduction temperature. This temperature is again lowered as more exhaust gases are returned. Because of the greater need to return more exhaust gas, the ejector nozzle 15 must be a variable nozzle so that it is able to allow more exhaust gases to pass through while nevertheless maintaining the purifying process, by collecting carbon particles from the bottom of the cyclone purifier and/or that exhaust gases are returned directly to the primary air duct 10 through a pipe 18 and through the agency of a further throttle means 17. Thus, there is found a point at which the reduction temperature can no longer be maintained, with the result that the heat value of the gas will fall and therewith cause a reduction in engine power. Instead of controlling the reduction temperature by means of the aforedescribed exhaust gas return process, the temperature can be controlled with the aid of water, steam or superheated steam, or these two processes may be combined. The water is injected prior to the primary air of combustion entering the exhaust gas/primary air heat exchanger when concerning steam generation. The water is metered by means of a device 19 which pumps the water or draws the water by suction into a pipe 20 upstream of the exhaust gas/primary air heat exchanger. When only water is to be supplied, the water is delivered to a point downstream of the exhaust gas/primary air heat exchanger by means of the device 19 and a pipe 21, instead of through the pipe 20. The water may be preheated, by passing it through an electric heating device.

CLAIMS

1. A s lid fuel gas generator comprising a primary air nozzle and a gas outlet, c h a r a c t e r i z e d in that the gas outlet is comprised of a fixed cylinder (1) which is closed at one end, a conduit for produced gas mounted at the other end of said fixed cylinder (1), an opening (2) which extends along at least a part of outer surface of the fixed cylinder (1), a rotatable cylinder (3) which is mounted for rotation in the fixed cylinder (1) and which carries a grating surface (5) which corresponds in shape and size to the opening (2) in the fixed cylinder (1); in that a primary air duct (10) is connected to the primary air nozzle (9); and in that a means (11) is provided for adjusting the height of the primary air nozzle in relation to the fixed cylinder (1).

2. A gas generator according to Claim 1 , c h a r a c t e r i z e d in that primary nozzle (9) is comprised of a tubular member which is closed at both ends thereof and which has an elongated primary air distributing slot and is connected to the fixed primary air duct (10).

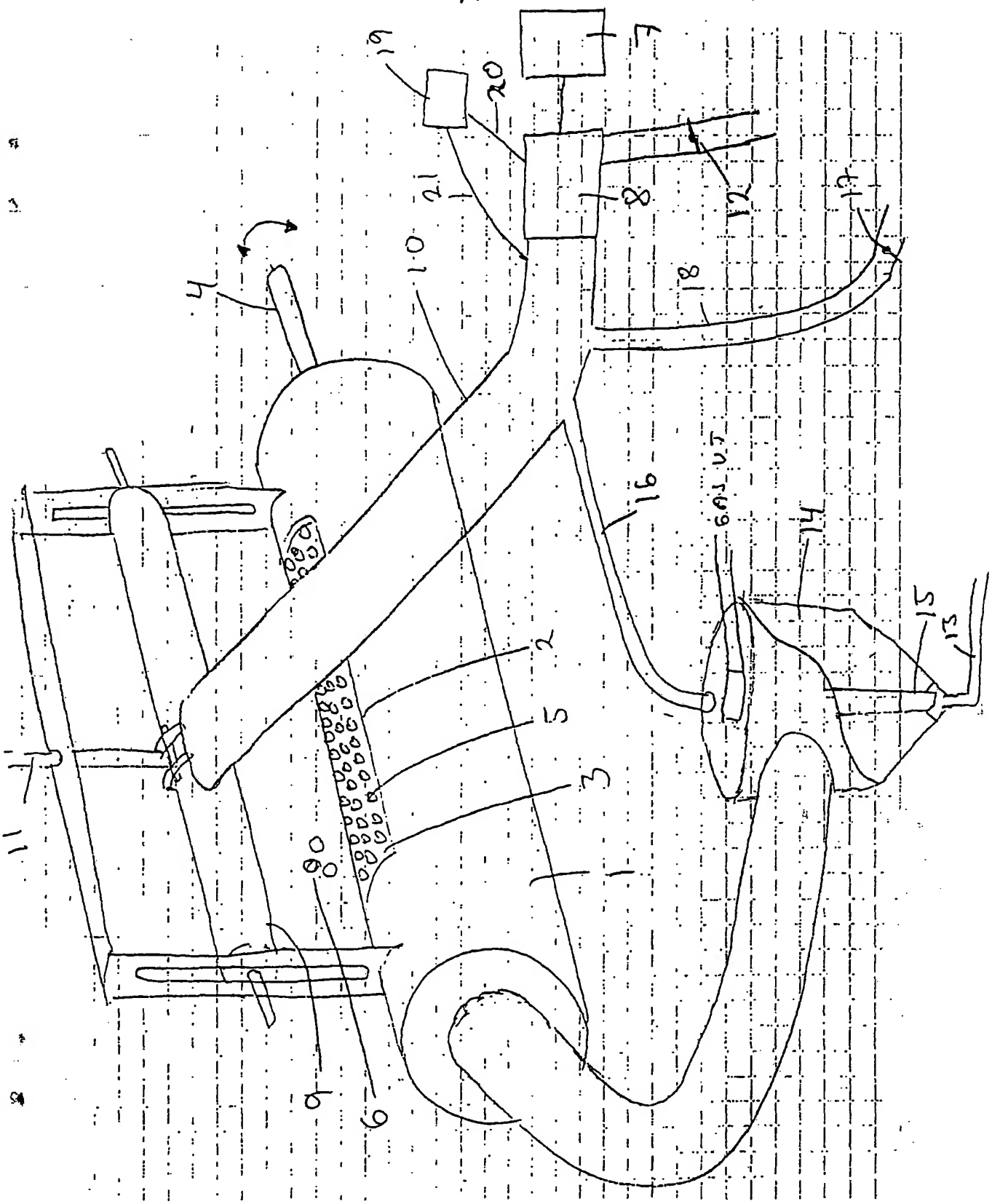
3. A gas generator according to Claim 1, c h a r a c t e r i z e d by means for returning and/or recovering waste heat and exhaust gas.

4. A gas generator according to Claim 1, c h a r a c t e r i z e d by means for introducing and distributing waste heat and exhaust gases.

5. A gas generator according to Claim 1, c h a r a c t e r i z e d by means for controlling the gasification process with the aid of waste heat and exhaust gases and/or with the aid of other generated heat.

6. A gas generator according to Claim 1, c h a r a c t e r i z e d by means for delivering fuel to a container that includes gas generating parts.

7. A gas generator according to Claim 1, c h a r a c t e r i z e d by a cyclone purifier for cleansing generated gas.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# INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 92/00726

## A. CLASSIFICATION OF SUBJECT MATTER

IPC5: C10J 3/26
According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: C10J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | DE, C2, 3790370 (WGE WASTE GAS ENERGY AB), 26 July 1990 (26.07.90) -- | 1 |
| A | Perry Nowacki, "COAL GASIFICATION PROCESSES", 1981, Noyes Data Corporation, (New Jersey, USA), page 78 - page 80 -- | 1 |

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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Information on patent family members

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| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| DE-C2- 3790370 | 26/07/90 | AU-B- 597409 | 31/05/90 |
| | | AU-A- 7700287 | 29/01/88 |
| | | CH-A- 675016 | 15/08/90 |
| | | EP-A- 0275279 | 27/07/88 |